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Original Article

THE IMPLEMENTATION OF TOURISM DEMAND FORECASTING USING SEASONAL ARIMA FOR THE INVESTMENT ANALYSIS OF FLOATING AQUACULTURE

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ABSTRACT

In order to improve the prosperity of coastal communities, the Ministry of Maritime Affairs and Fisheries has apropos strategy by building and revitalizing the aquaculture floating structures as the facilities for fish farming. This research is focusing on floating aquaculture in the region of Kenjeran Beach, Surabaya. Then, before building the facility of floating aquaculture, the proper analysis of investment should be studied. The methods used in the analysis of investment are BEP and NPV, the values of which are obtained from the variable cost of production and revenue. Cost of production, includes the building and maintenance cost (gasoline and service, seed & feed cost, labor cost and transportation cost. The revenue obtained from the fish cultivation, which can be sold also the floating aquaculture tourism arrival. The amount of fish is assumed as a fixed parameter depending on the dimensions of the cultivated area. The arrival tourism will be fluctuating every year, which is known by using SARIMA method. This final research is getting the value of BEP in the fourth years, which is every cost will be paid off in the fourth years.

KEYWORDS: Floating Structure, Aquaculture Investment & SARIMA

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INTRODUCTION

Sea pollution caused the lessening of fish catch. For example, in the coastal areas of Surabaya and Jakarta, rarely found the amount of fish caused by heavy metal pollution which is hard to control. It will be influenced to the decreasing of fisherman welfare. To improve their quality life, the fish cultivation activity is the suitable method for them. The land fish cultivation is less efficient in a big city, because of the high price of terrain area and the difficulty of operational access. The target of fish production from The Ministry of Maritime Affairs and Fisheries as can be shown in Table 1. [6]

Table 1: The KKP's Fisheries Sector Data [6]

No.	Fisheries	2012	2013	2014	2015	2016
1.	Catch	1,07	1,06	1,08	1,12	1,21
2.	Cultivation	1,07	1,15	1,27	1,36	1,51

In 2017, KKP will be revitalized 1000 floating aquaculture which can't be operated in Indonesia. The factors caused by no modals and operational costs. Also KKP will be cooperated with two associations and one research affair to study the management of floating aquaculture. With this study including the diversity of sea

fish that has potential to be cultivated and finance operational support, it will be hoped that floating aquaculture will be surplus at the end of 2017. It should be definitely supported by a hydrofoil fishing vessel that can be able to move fast. [6]

Recording to the increasing of fish production, sea fish cultivation which building floating aquaculture is the method which is the best solution. The study of floating aquaculture is immensely important to get the operational floating aquaculture and reach the business target. This research will be focused on investment study of floating aquaculture with cash flow method by using SARIMA approach for the amount of tourist forecasting. So, it can be a model for the business aquaculture properness of investment.

LITERATURE REVIEW

Seasonal ARIMA is the suitable method to use for forecasting the arrival of tourism. Standard procedure used to form the model of ARIMA is Box-Jenkins Method. The stationary of time series data is the important requirement should be noticed to form the model of ARIMA. The stationary of time series data is the condition where generate process that underlie the continuous row based on the average value and the constant variant value. [9]

In 2016, the research about the arrival tourism in Beach Kenjeran had been done which took the arrival data started from 2011-2016. The data was used to make forecasting equation about the arrival tourism in 2017 -2022. The study about floating aquaculture investment has been done by many researchers in many countries. The micro analysis of floating aquaculture in Mozambique showed that the value of NPV is positive. The value is USD 891 with the capacity of aquaculture is 500 m^2. The aim of this project is to make an economic analysis of small-scale fish farm investment and operations under the environmental and financial conditions. [7] At Uganda, the calculation of the fish cultivation cost including seed, feed, labor, production and transportation cost. The result was the margin profit got was low caused by the higher prize of cultivation than sell prize. [4]

The fish cultivation in South East Asia gave positive information about the opportunities of this business. Nevertheless based on research this potential didn't be used optimally caused by the facilities, resources even by the policy from the government. One of the advances countries in aquaculture business was Norway. The management of floating aquaculture was gave to the private sector which consisted as the structure provider of the floating aquaculture and 2 feed provider of the floating aquaculture. [5] In Indonesia, the research was focused on how long would be the capital was paid off and it would be profited or not. Which was the average paid off time was at the 4^{th} or 5^{th} years. Furthermore, the environments and socio-economy were the reasons that blocked the growing of fish cultivation. As long as the research has been done, it was proved that the government policy was the most blocking reason of fish cultivation. [2]

RESEARCH METHODS

Model Identification and Estimation of Sarima Models

Once the issues of stationary and seasonality are resolved, the next step is to identify the model form and estimate the parameters. There are two commonly applied methods for the estimation of a general ARIMA model: (i) the Box–Jenkins procedure and (ii) the use of information criteria or penalty function criteria. The former method is known to be biased with an identification procedure that primarily relies on autocorrelogram plots of the data. Other methods have since been developed to overcome the shortcoming of the Box–Jenkins approach but these are also centered on ACFs and are prone to thesame limitations as the Box–Jenkins methodology. Acomprehensive review on the various methods is presented in the literature by the previous research. In this article, the penalty function approach is adopted for the purpose

of model identification and estimation under the SARIMA framework. SARIMA models are seasonal/periodic extensions of the simple ARIMA models. A simple ARIMA model consists of three parts: 'AR', that is, the AR part; 'I', that is, the differencing part; and 'MA', that is, the moving average (MA) part. The equation representing an ARIMA (p, d, q) model for a time series sequence y_t can be mathematically written as can be shown in Equation 1.

$$y_t = \varphi_1 y_{t-1} + \varphi_2 y_{t-2} ..... + \varphi_p y_{t-p} + \varepsilon_t + \vartheta_1 \varepsilon_{t-1} + \vartheta_2 \varepsilon_{t-2} + \vartheta_q \varepsilon_{t-q} \quad (1)$$

Where y_{t-p} represents time series data at different lags; φ and ϑ the unknown parameter; p= order of the AR process; d=order of differencing; q= order of the MA process; and ε are the independently and identically distributed terms (representing the MA part). Equation (3) can be written in a different form (equivalent but shorter version) as can be shown in Equation 2. With L representing the backshift or lag operator, Δd the difference (1−L) d, and ϕ and θ the lag operator polynomials. In order to incorporate seasonal variation in time series, the ARIMA model can be extended as in Equation 3.

$$\varphi(L)\Delta^d y_t = \theta(L)\varepsilon_t \quad (2)$$

$$\varphi(L^S)\theta(L)\Delta_S^D \Delta^d y_t = \varphi_Q(L^S)\theta(L)\varepsilon_t \quad (3)$$

Where Δ_S^D is defined as the seasonal difference $(1-L)^D$ and φ and θ the lag operator polynomials. The notation is represented by SARIMA (p, d, q) (P, D, Q) s, with P, D, Q representing the seasonal AR order, integration order and MA order, respectively, and s being the length of the season, which in the case of monthly time series is 12 months. Two penalty functions statistics are implemented: the Akaike information criterion (AIC) and the Schwarz/Bayesian information criterion (SIC/BIC). Information criteria approaches such as the AIC combine two concepts into one framework: an error control procedure that controls for the prediction error and the maximum likelihood principle that serves as a measure of fit.[1]

The Suitable Decision Method

There are so many the possibilities of models found. So, it is immensely important to choose the best model forecasting the next periods. Means Square Error (MSE) is the best decision method based on the residual value of forecasting. The value of MSE is getting by the Equation 4. The value of Mean Absolute Percentage Error (MAPE) also can be used as the criteria of the best model decision. MAPE is getting by the Equation 5. The value of Mean Absolute Error (MAE) also can be used as the criteria of the best model decision. MAE is getting by the Equation 6.

$$MSE = \frac{\sum_{i-1}^{n} (Y_t - Y_i)^2}{n} \quad (4)$$

$$MAPE = \frac{\sum_{i-1}^{n} \left| \frac{Y_t - \hat{Y}_t}{Y_t} \right|}{n} x100\% \quad (5)$$

$$MAE = \frac{\sum_{i-1}^{n} \left| Y_t - \hat{Y}_t \right|}{n} \quad (6)$$

Production and Maintenance Cost

Operational cost is cost to be paid for daily operational ship making ship ready to sail. Things include in operational costs are crew cost, maintenance and repairing cost, logistics cost, oil cost, assurance and administration. [8] Equation 7 shows the operational cost that is a reference for this calculation. Structural Cost is cost to be paid for need of profiles and ship plates as can be shown in Equation 8. Outfitting and Equipment Cost is cost to be paid for need of outfitting and equipment of ship as can be shown in Equation 9. Machinery Cost is cost to be paid for need of machinery of ship as can be shown in Equation 10. Non Weight Costs is cost that can't be categorized as the previously cost. The cost can be shown in Equation 11. So, The Total Cost (TC) is as can be shown in Equation 12.

$$OC = M + ST + MN + I + AD \tag{7}$$

$$P_{ST}(US\$) = W_{ST}\,xC_{ST} \tag{8}$$

$$P_{E\&O}(US\$) = W_{E\&O}\,xC_{E\&O} \tag{9}$$

$$P_{ME}(US\$) = W_{ME}\,xC_{ME} \tag{10}$$

$$P_{NW}(US\$) = C_{NW}\,x(P_{ST} + P_{E\&O} + P_{ME}) \tag{11}$$

$$TC = P_{ST} + P_{E\&O} + P_{ME} + P_{NW} \tag{12}$$

Where OC is defined as operation cost, M is defined as manning cost, ST is defined as store cost, I is defined as insurance cost, AD is defined as administration cost. $W_{ST}$is defined as the weight of ship steel and C_{ST} is defined as cost approach of the steel weight per tons. $W_{E\&O}$is defined as the weight of outfitting and equipment of ship and $C_{E\&O}$ is defined as cost approach of the outfitting and equipment weight per tons. $W_{ME}$is defined as the weight of machinery of ship and C_{ME} is defined as cost approach of the machinery weight per tons.

RESULT AND ANALYSIS

Knowing the amount of arrival tourism in 2017-2022 needs the arrival tourism from 2011-2016. Furthermore the data is like in Figure 1.

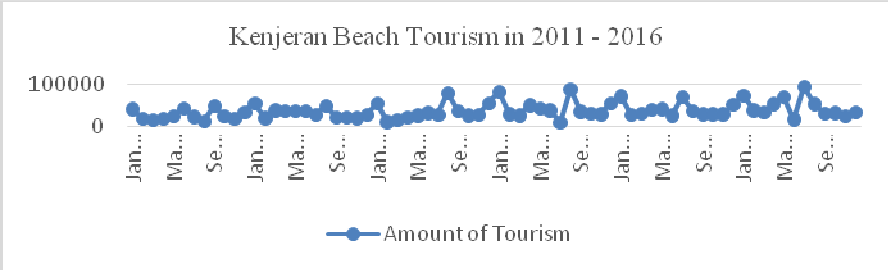

Figure 1: The Arrival Tourism in Kenjeran 2011-2016

Figure 1 shows about the arrival tourism in Kenjeran Beach from 2011 – 2016. This data had been forecasted with SARIMA method. The model of ARIMA used to forecast the amount of arrival tourism in Kenjeran Beach is good enough according to the minimum value of MSE, MAPE and MAE. Based on ARIMA assumption which is ARIMA ([7],0,0); ARIMA ([7[,0,[12]); ARIMA ([10].0,0); ARIMA ([10],0,[12]); ARIMA ([7,10],0,0) and ARIMA ([7,10],0,[12]). Only the model of ARIMA ([10],0,[12]) and ARIMA ([7,10],0,0) classified with Residual White Noise assumption. Table 2 shows that the only two ARIMA models fulfilling the White Noise criteria. The criteria of ARIMA models accepted are that the

value of P is not less than 5%.

Table 2: The Summary of White Noise Analysis

Model	Residual			
	Lag	P value	Decision	Summary
ARIMA ([7],0,0)	6 12 18 24	0.0248 0.0056 0.0011 0.0064	H_0 rejected	No White Noise
ARIMA ([10],0,0)	6 12 18 24	0.0844 0.0023 0.0255 0.0227	H_0 rejected	No White Noise
ARIMA ([10],0[12])	6 12 18 24	0.2303 0.4401 0.8273 0.8717	H_0 accepted	White Noise
ARIMA ([7,10],0,0)	6 12 18 24	0.1017 0.6814 0.2403 0.3518	H_0 accepted	White Noise

Getting the one proper model of ARIMA should be calculated the most minimum value of MSE, MAPE and MAE. From Table 3, model of ARIMA ([10],0,[12]) has the most minimum value of MSE, MAPE, and MAE, so it is proper to be chose as the model of regression forecasting of tourist arrival in Kenjeran Beach. Table III shows about the minimum value of MSE, MAPE and MAE which is being a requirement to forecast using ARIMA method. The formula of model of ARIMA ([10],0,[12]) meaning that prediction of arrival tourism in Kenjeran Beach influenced by the observation result in ten months ago and the error prediction in the twelve months ago. The equation 13 shows the amount of tourist. Then, with equation 13 the tourist arrival in 2017-2022 can be seen as Figure 2.

$$Z_t = 4734534 - 0.31843Z_{t-10} + 0.38539a_{t-12} + a_t \quad (13)$$

Table 3: The Most Minimum Value of MSE, MAPE, and MAE

Model	MSE	MAPE	MAE
ARIMA ([10],0[12])	513323359.3	34.25 %	13535.32
ARIMA ([7,10],0,0)	650112792.3	37.01 %	16242.21

Figure 2 shows about the result of forecasting using ARIMA method. Figure 2 shows about the forecasts of tourism arrival in Kenjeran Beach start form 2017-2022. After knowing the forecasts of arrival tourism in Kenjeran Beach next is making the dimension of Floating Aquaculture. The floating aquaculture can retain the fish cultivation as many as 200 ton. Figure 3 shows the construction profile of aquaculture floating structure used to calculate the production cost.

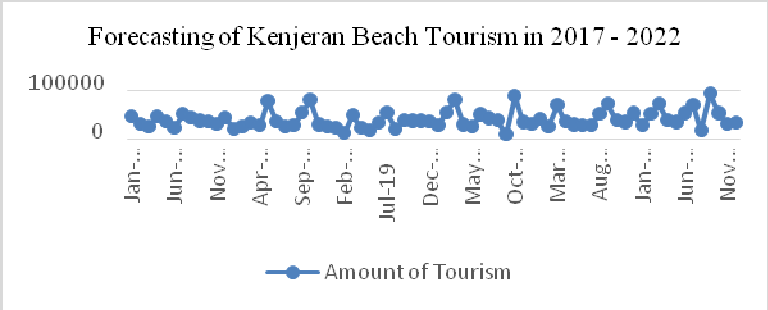

Figure 2: The Forecasts of Tourism Arrival in Kenjeran 2017-2022

Table 4 shows the building cost of floating aquaculture that needs IDR 41,842,729,500 it is mean the prize of aquaculture per unit is IDR 41,842,729,500. After getting the prize of floating aquaculture, next is calculate the operational cost per month. Table 5 shows the operational cost per month of floating aquaculture. After getting the calculations needs to build the floating aquaculture, next is analyses the investment of floating aquaculture. Table VI shows the investment analysis of aquaculture floating structure.

Table 4: The Component of Production Cost

Item	Vol.	Unit Price in M (IDR)	Total in B (IDR)
Steel	1254	15.00	18.79
Profile	12.53	8.25	1.08
Outfitting	1	5.12	5.12
Machinery	1	9.96	9.96
Labor Cost	1	3.51	3.51
Variable Cost (VC)			38.04
Fixed Cost (Assumption 10% of VC)			3.80
Production Cost			41.84

Table 5: The Operation Cost

Item	Vol.	Qty.	Unit Price in K (IDR)	Total in M (IDR)
Machinery Oil	40 ton	2	8.55	684
Auxiliary Oil	30 ton	2	8.55	513
Lube Oil	10 ton	2	9.50	190
Crew Cost	20 crews		15,000.00	300

Table 6 shows about the proper analysis of floating aquaculture investment. From that table the Breakeven point will be happened at 4th years and the value of NPV is positive.

Table 6: The Investment Analysis

Item	Value	Criteria	Min
Present Worth (NPV)	9,435 M	OK	0
Present Worth Index (NPVI)	28 %	OK	0 %
NPVI from Years	3	OK	15 %
Break Even Point	4	OK	1

CONCLUSIONS

Regarding to the calculation of building cost of floating aquaculture, the selling price of the life tuna fish is IDR 75,000. The cultivation time from the young fish to the harvest time is about 8 months. The ticket prices per person is IDR

45,000 with assumption 20-30% will come to the floating aquaculture. With these assumptions, the breakeven point of aquaculture floating structure is in 4 years.

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